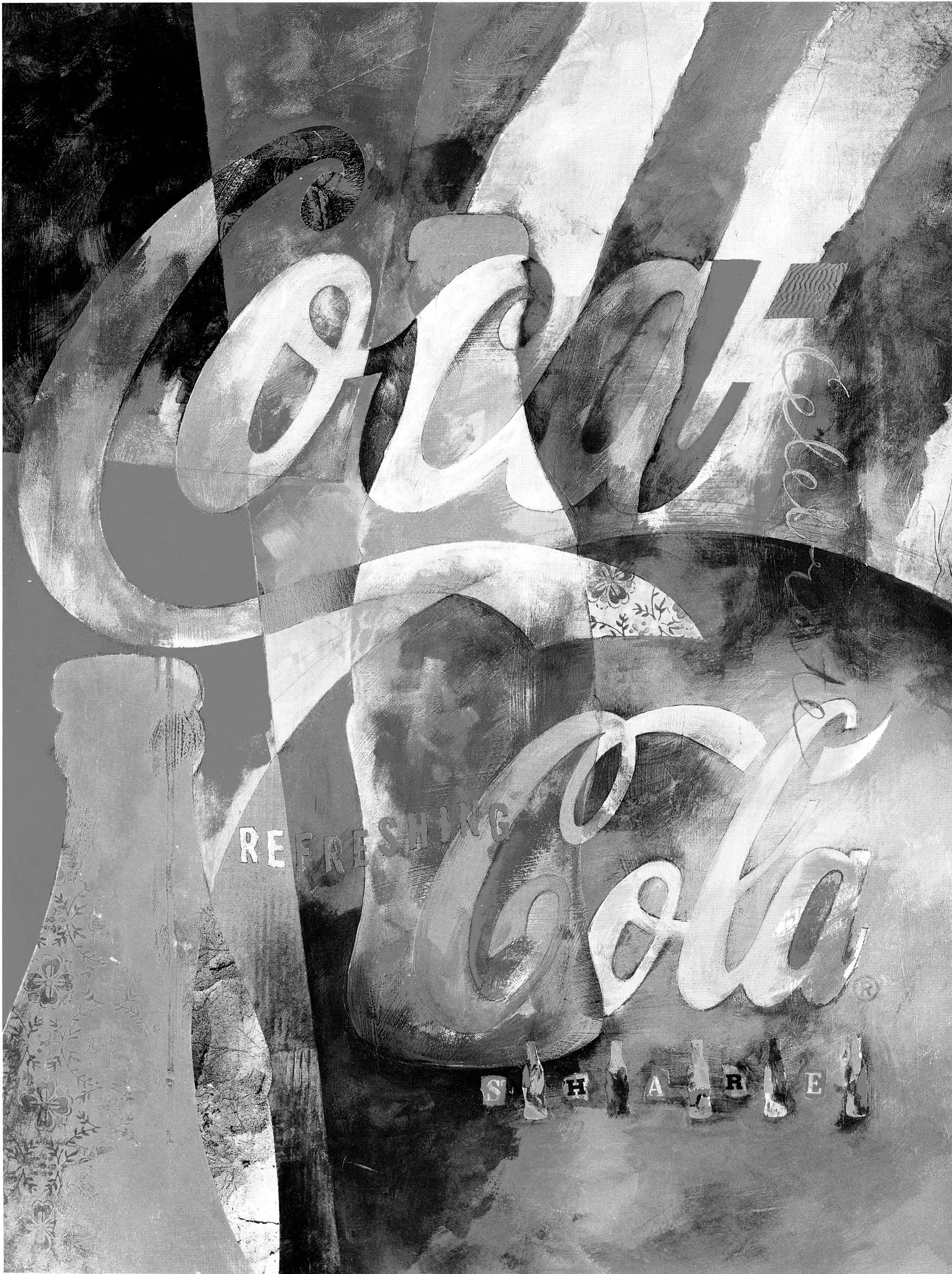


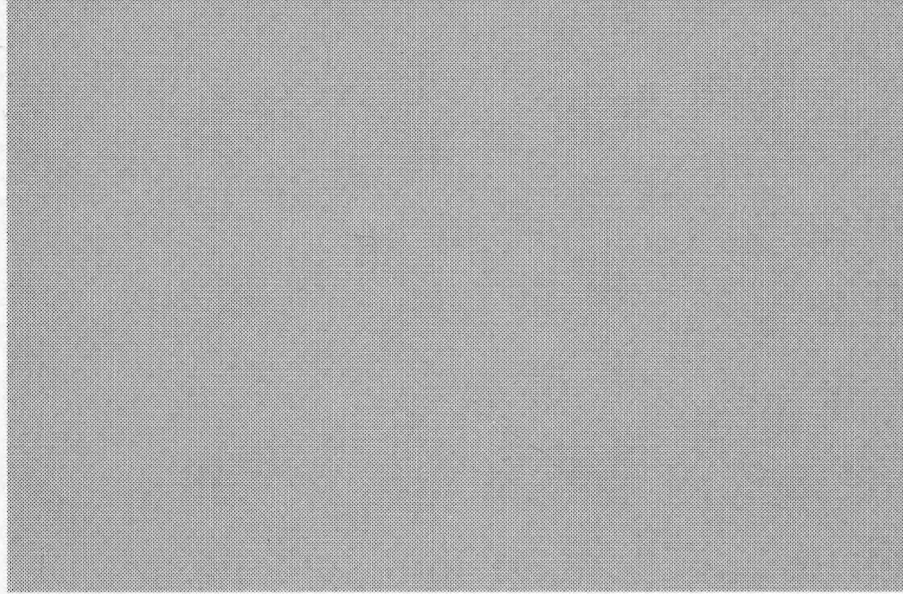
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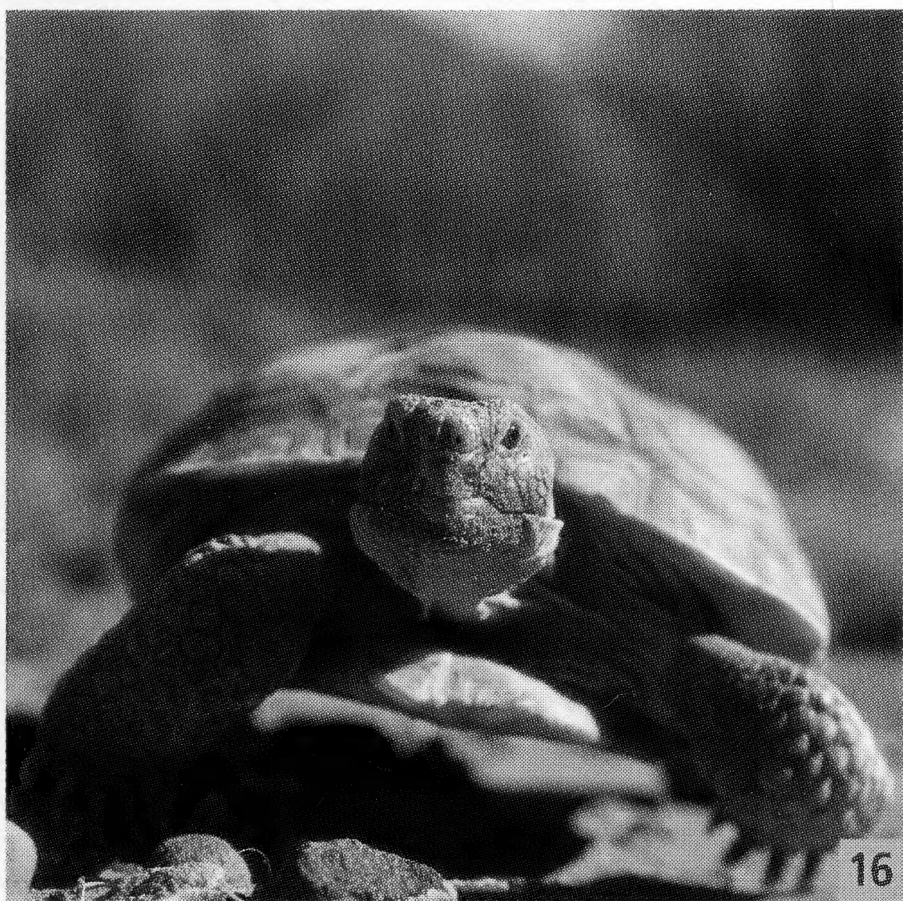
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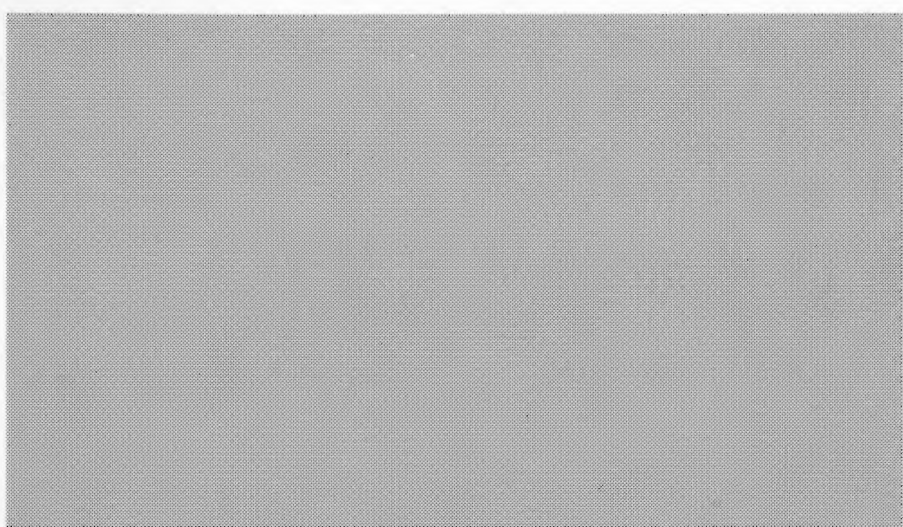
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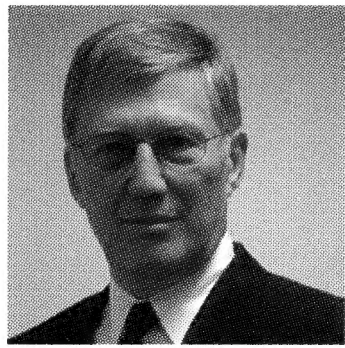
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FONZForum

A New Era for FONZ

I have been with Friends of the National Zoo since 1989, serving as Deputy Executive Director for 16 years and as Executive Director for the last 16 months. My service with FONZ followed a 26-year career in the Army. Now it is time for me to move on to the next phase in my life. In July, Robert J. Lamb will become the new Executive Director of FONZ. I will continue as a senior advisor to him as he builds his senior management team.

Bob brings 35 years of leadership and management experience to FONZ. He has served in a variety of senior positions in the U.S. Department of the Interior (DOI) since 1977, most recently as senior advisor for management and collaborative action in the Office of the Secretary. During his tenure, Mr. Lamb addressed management, budget, and policy issues across the DOI and its eight component bureaus and worked to advance the role of public-private partnerships in accomplishing natural resource conservation goals. Before joining the DOI, he served as a management intern in the former U.S. Department of Health, Education, and Welfare (now Health and Human Services).

During his DOI career, Bob received two Presidential Awards for Distinguished Career Achievements, three Presidential Awards for Meritorious Career Achievements, a DOI Distinguished Service Award, a DOI Meritorious Service Award, and the Secretary of the Interior's Partnership Award for Conservation through Communication, Cooperation, and Consultation.

Bob is looking forward to leading FONZ as our organization grows and changes to meet the needs of the Smithsonian's National Zoo, which is also growing and changing under the leadership of Zoo Director John Berry. The Zoo will need our support—and yours—more than ever as it works to become the world's finest zoo by 2016, the goal John Berry sets out in his letter on the facing page. I am confident that Bob Lamb is the right person to lead FONZ and help lead the Zoo into that glorious future. And I am confident that you will extend to him the same generous support you have given me.

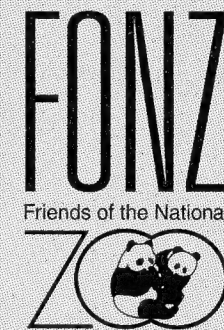
I have thoroughly enjoyed my years at FONZ. Where else could I have watched a tiger giving birth, made budget decisions, helped school kids learn about wildlife and conservation, and provided support to the Zoo—all in a single day—and the next day focused on four or five other efforts of our diverse organization? I had the pleasure of serving under the distinguished leadership of Clint Fields during most of my tenure, and I have been fortunate to lead, and sometimes be led by, a talented, dedicated staff, many of whom I have worked closely with since the day I arrived at FONZ. It has also been a pleasure to work with the members of the FONZ Board of Directors, the staff and leadership of the Zoo and the Smithsonian, and with you and all FONZ members. I'm delighted that in my advisory position I will remain a part of this wonderful team.

I am also proud that FONZ is having one of its most successful years ever. Our revenues have been extraordinary—some \$8.7 million in the year's first five months—enabling FONZ to extend an unprecedented \$2.6 million worth of support to Zoo programs so far this year. Membership has reached an all-time high of nearly 39,500 households, encompassing some 90,000 individuals. Our recent fundraisers, ZooFari and Guppy Gala, attracted a record number of guests and earned record proceeds. And we are looking forward to the fall opening of the exciting new Fujifilm Giant Panda Habitat and Asia Trail, which your generous contributions helped to build.

Please join me in extending a warm welcome to Bob Lamb and in looking forward to an even greater Friends of the National Zoo in the years ahead. Thank you.

Sincerely,

James M. Schroeder
Executive Director



is a nonprofit organization dedicated to supporting the conservation, education, and research efforts of the Smithsonian's National Zoo. Formed in 1958, FONZ was one of the first conservation organizations in the nation's capital. Friends of the National Zoo is dedicated to supporting the National Zoo in a joint mission to study, celebrate, and protect the diversity of animals and their habitats.

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Membership in FONZ offers many benefits: programs, publications, discounts on shopping and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, 3001 Connecticut Ave., N.W., Washington, D.C., 20008-2537, call 202.633.3034, or go to www.fonz.org.

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On the cover: The nutritional needs of the desert tortoise (*Gopherus agassizii*), shown here near St. George, Utah, are being studied by a Smithsonian's National Zoo scientist. Photo by William H. Mullins.



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The Smithsonian's National Zoo is accredited by the Association of Zoos and Aquariums.

Letter from the Zoo Director



Moving Forward: The National Zoo's Strategic Plan

By 2016, we will be the world's finest zoo.

Our planet is amazingly rich and abundant with life. We share its land, water, and sky with a magnificent diversity of wildlife. We have a responsibility to conserve species and their habitats, so that we leave our children and grandchildren a world that is even richer and more abundant.

At the Smithsonian's National Zoo, we seek to inspire, train, and empower successive generations to care for the world's biological diversity. Our tools are our exhibits, science, outreach, and education programs. Ultimately, everything we do must be oriented toward protecting wildlife and other forms of biological diversity so that we, and future societies, continue to enjoy the incalculable benefits of our natural world.

Today, thousands of species—some of them in the care of the National Zoo—are facing extinction, and many fragile ecosystems critical to the well-being of societies around the world are under great strain from human activities. As the challenges of safeguarding the Earth's living heritage grow, so does the National Zoo's determination to play a leading role in shaping a brighter future for both people and wildlife.

In this context, we have developed a ten-year strategic plan to guide our activities toward achieving an ambitious goal: By 2016, we will be nothing less than the world's finest zoo, recognized, as befitting the nation's zoo, as a global leader in four core areas:

Animal care—We provide the highest quality animal care. The Zoo's animals are its heart and soul. Zoo staff from diverse departments work together to support the animals' environmental, nutritional, medical, and behavioral needs, and we must be a learning organization that applies the latest knowledge, technology, and best practices in animal care. At the same time, we work to establish healthy animal populations in the wild.

Science—We advance scientific excellence in conserving wildlife. Scientific excellence is essential to our science-based approach to conservation, exhibitions, and education. Our talented scientists form one of the world's largest conservation science staffs. We must continue to discover new knowledge to address conservation problems, develop science-based solutions to mitigate the loss of biodiversity, aid in the survival and recovery of species and their habitats, and ensure the health and well-being of animals in zoos and in the wild. We must also continue to build conservation capacity worldwide through professional training of the next generation of conservation leaders.

Education—We teach and inspire people to engage in conservation of wildlife, water, and habitats. Through public programs, we must educate and motivate people of all ages and backgrounds about animals, their habitats, challenges to their survival, and science and conservation programs underway to protect their future. Key to this is providing inspiring and dynamic science-based exhibits and public programs.

Sustainability—We practice conservation leadership in all we do. Based on our excellence and leadership in zoo and conservation science and education, we will become a leading national provider of objective science-based information and educational materials relating to the conservation of species and their habitats to diverse audiences including policymakers, media, and the public. We must also show our commitment to sustainability through modeling conservation best practices, such as recycling technologies and alternative energy use, in everyday Zoo operations, and by using environmentally sound materials and practices in all operations and renewed facilities.

I am confident we can be the world's finest zoo because we are passionate about our mission and we start with many powerful assets, the most important of which are our outstanding and dedicated staff and our core group of enthusiastic volunteers and supporters from Friends of the National Zoo. We will also enlist the support of our Smithsonian colleagues, funders, conservation organizations, and governments worldwide to protect the world's wildlife and their habitats. Equally critical is our commitment to engaging the public to play an active role in this effort.

I am certain that the National Zoo's best days lie ahead, and that we will play a major role in helping to ensure future generations will experience an even richer and more abundant world of wildlife. I look forward to your continued generous support.

Sincerely,

John Berry

Director, Smithsonian's National Zoological Park

P.S. We welcomed three new Sumatran tiger cubs to the Zoo family on May 24. The birth of these cubs, the second litter of Sumatran tigers born in the last two years, exemplifies how our excellent science-based animal care contributes to creating a sustainable zoo population of this endangered tiger subspecies. And nothing is more inspiring than the sight of tiger cubs gamboling through their habitat at Great Cats, where you can learn about efforts to conserve tigers in the wild and how to join these efforts. Watch our website for news about when these cubs will make their public debut.

Notes&News



The Smithsonian National Zoo's new meerkats are now on exhibit at the Small Mammal House.

Animal News

There are mobs of new animals at the Smithsonian's National Zoo—literally. Two species that live in social groups called mobs, meerkats and tammar wallabies, are now on exhibit. Stop by the Small Mammal House to see the six **meerkats** (*Suricata suricatta*), frisky members of the mongoose family native to southern Africa. Meerkats often stand upright on their hind feet, using their tails to stay balanced as they bask in the sun or scan the horizon for threats. They live in groups of up to 30 individuals, and adults take turns standing guard while the rest of the mob digs for tasty invertebrates. If a predator approaches, these “sentinel” meerkats sound an alarm bark and the mob may retreat to its underground burrows. And don't miss the mob of four adult and two baby **tammar wallabies** (*Macropus eugenii*) that now inhabit an outdoor exhibit between the Cheetah Conservation Station and Panda Plaza. These Australian marsupials nurse their young, called joeys, in pouches on their abdomens. They are smaller than red and gray kangaroos but share similar traits, including powerful hind legs that they use to hop or leap.



Green-crested basilisk (*Basiliscus plumifrons*).

Soyono, the Zoo's adult female **Sumatran tiger** (*Panthera tigris sumatrae*), gave birth to three cubs on May 24, two females and one male. This is the third litter for Soyono and mate Rakan. Their first cub, Berani, was born in 2001 and now lives at the San Antonio Zoo; their second litter of three males was born in May 2004 and all three brothers live at the Downtown Aquarium in Denver. The tigers were

bred under the auspices of the Association of Zoos and Aquariums' Species Survival Plan for Sumatran tigers, a joint effort among North American zoos to maintain a healthy population of the subspecies because only about 400 Sumatran tigers remain in the wild. The cubs will make their public debut around the end of August.

Visit the **Reptile Discovery Center** for a fresh look at the fascinating lives of reptiles and amphibians. Brand-new interactive video touch screens, hands-on objects, and colorful, larger-than-life graphics immerse you in the world of the nearly 70 species on exhibit there. You can watch a basilisk run on top of the water's surface, touch a crocodile skin, and examine a python's jaw, while learning why these animals need our help for their survival.

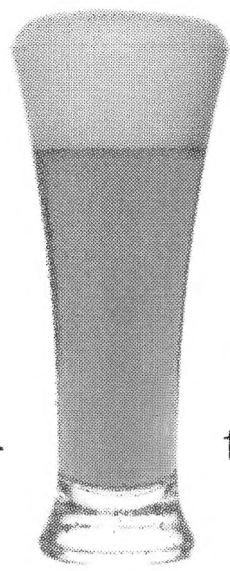
Events

Sunset Serenades

Thursdays, June 29 to August 10—
6:30 to 8 p.m.

Sponsored by Starbucks Coffee Company,
WARW Radio, and Yellow Book.

Enjoy seven evenings of free musical entertainment on the lawn of the Zoo's Lion/Tiger Hill. With a range of musical styles including big band, classic rock, blues, and reggae, these concerts are sure to please people of all ages.



whistle and relax with your friends at Brew at the Zoo, FONZ's beer-tasting event for Young Professionals. Enjoy handcrafted beers, hors d'oeuvres from local restaurants, and live entertainment while visiting the Zoo's animals and contributing to a great cause. This year's proceeds will benefit the Zoo's Asian Elephant Conservation Fund. Tickets are on sale at www.fonz.org/after-hours.htm.

Save the Date for the Grand Opening of Asia Trail

September 20, 2006

Don't miss your chance to be among the first visitors to see Asia Trail, the Zoo's newest exhibit. Asia Trail will feature sloth bears, fishing cats, clouded leopards, red pandas, small-clawed otters, giant salamanders, and an expanded Fujifilm Giant Panda Habitat for Tai Shan and his parents. For more information, visit www.fonz.org/asiatrail.htm.

Tai Shan's Birthday

July 9—10 a.m. to 2 p.m.

Celebrate the first birthday of the Zoo's giant panda cub at the Fujifilm Giant Panda Habitat. Fun activities include keeper talks, arts and crafts, and free birthday cupcakes for the first 1,000 visitors. Wish Tai Shan many happy returns by picking up a blank birthday card at a local participating Whole Foods or Panda Express, decorating it, and bringing it to the big bash, where we'll display it. For more information, visit www.fonz.org/events.htm.

Brew at the Zoo

August 24—6 to 9 p.m.

After a long day at work, come whet your



The Zoo's new sloth bear cub and his parents will move to Asia Trail this fall.

Volunteer Corner

by Molly Woods



Volunteer interpreters enjoy the diversity of species, which includes naked mole-rats, in the Small Mammal House.

If you want to see a fennec fox, mouse deer, and naked mole-rats under one roof, stop by the Zoo's Small Mammal House. Volunteer interpreters talk to visitors about the more than 30 species that live there, including small reptiles and birds in multispecies exhibits.

Todd Marshall has been a small mammal interpreter since the beginning of the program in 2000 and can't pick a favorite animal because "you could have a different favorite every day." He enjoys

volunteering in the Small Mammal House because "you get to learn a lot about all of the animals at the Zoo, and our species are related to other species at the Zoo." For instance, learning about the Small Mammal House's leopard cat can teach a visitor a lot about the Zoo's lions and tigers. Lucia Bragan, who joined the program in September 2005, likes being a small mammal interpreter because of "a lot of variety and a lot of support from the staff."

If you're interested in volunteering in the Small Mammal House, contact program supervisor Laura Klopfer at klopferl@si.edu or 202.633.1105. Training will begin soon.



Storm clouds gather above an expanse of prairie in northeastern Montana, where conservationists are recreating a vast grassland ecosystem.

Grasslands

BY JEFFREY P. COHN

ON A GRAND SCALE

On a cold, windy November day last year, Bill Eichbaum stared in awe as 16 American bison (*Bison bison*) that had been confined in a 100-acre outdoor pen for six weeks noticed an open gate in their paddocks. They ambled slowly out, led by a dominant bull, and entered the seemingly endless prairie of northeastern Montana. Suddenly, like wind whipping through tall grasses, they bolted across the prairie for a few minutes, then settled down to graze as if nothing had happened. Eichbaum and other spectators watched and cheered, some teary eyed.





Steven Morello/WWF

Wildlife reserves on the Great Plains provide contiguous habitat to bison, pumas, bighorn sheep, swift foxes, and other species less common on prairies today than they were before human settlement.

The bison were released into the wild in a part of the northern Great Plains that had not seen the shaggy animals running free in more than a century. “Maybe I’m a bit of a romantic at heart, but it really moved me,” says Eichbaum, the World Wildlife Fund’s (WWF) vice president for endangered species. “It was really inspiring. We were all a bit giddy.”

The scene unfolded on a ranch in Phillips County, Montana, just north of the Charles M. Russell National Wildlife Refuge, which straddles the Missouri River. The ranch is part of what the WWF and its partner, the American Prairie Foundation (APF), hope will become a grasslands reserve encompassing several million acres of mixed-grass prairies, riparian woodlands, and ephemeral streams. “We want to piece together public and private land to bring back the grandeur of the Great Plains,” says Curtis Freese, the WWF’s program director for the northern Great Plains.

Other conservation groups have purchased large tracts of land for wildlife reserves, but none on the scale that the WWF and the APF (which was created by but is now independent of the WWF) have proposed for their grassland reserve in Montana. The National Audubon Society, for example, owns the 26,000-acre Paul J. Rainey Wildlife Sanctuary in Louisiana and others around the country, and The Nature Conservancy has the 60,000-acre Matador Ranch in Montana and about 1,400 other reserves throughout the United States.

The WWF and the APF see bison as a first step in their plans to recreate grasslands in northeastern Montana, and “to provide visi-

tors a rich visual experience over a large landscape,” Eichbaum says. The 16 bison released in November 2005 came from a herd at Wind Cave National Park in South Dakota; unlike many bison in the West, which are interbred with cattle on ranches to make them easier to handle and better meat producers, they are genetically pure. They’re also free of brucellosis, a disease that among cattle causes calves to be stillborn.

In addition to bison, the landscape once included elk, mule deer, pronghorn, bighorn sheep, and prairie dogs, as well as pumas, wolves, grizzly bears, swift foxes, and black-footed ferrets. Most of these species were eliminated from the area or significantly reduced in numbers after white settlers began to farm and ranch there in the 19th century. Bighorn sheep, elk, and pronghorn have been reintroduced to portions of northeastern Montana, while pumas have returned on their own. Some of the others may, like bison, need help coming back.

Sean Gerrity, the APF’s president, says “We are very excited to have bison back. They are a symbol of the West, but they are just one species. We want to restore the whole community of plains plants and animals.”

Big Plans for the Great Plains

The idea of creating a grasslands reserve in the northern Great Plains stems, in part, from two controversial proposals made in the 1980s. Frank Popper, a professor of urban studies at Rutgers University in

New Brunswick, New Jersey, and his wife Deborah Popper, a geography professor at the City University of New York on Staten Island, wanted to establish “buffalo commons.” Around the same time, Robert Scott, a retired engineer and rare book dealer with a long-standing interest in the Great Plains, wanted to create what he called the “big open.”

Both proposals advocated phasing out ranches—which had long dominated prairie landscapes, the economies of prairie towns, and the politics of western states—and replacing them with an economy based on wildlife and ecotourism. “Farming has never been very profitable and ranching has economic problems,” says Frank Popper. Not only are ranching and farming not profitable on the northeastern Montana plains, but, Scott notes, they are heavily subsidized by government agencies as well.

“It’s always been boom and bust on the Great Plains,” Popper adds. “We’re in a long bust period that began about 1920.” He points to the area’s lack of rainfall (12 inches or less on average in northeastern Montana), falling beef prices as people eat less red meat, a declining and aging population, depressed land values, and a stagnant economy in northern and northeastern Montana. “Plan A no longer works,” Popper states. “Montana needs to find an alternative.”

Census and other data seem to support the Poppers’ argument, according to a 2004 report of the Northern Plains Conservation Network, a coalition of environmental groups. Take population. As young people leave Montana ranches, farms, and small towns for better economic and professional opportunities elsewhere, the average age of the region’s ranchers and farmers now stands at 60. Not surprisingly, the numbers of most demographic groups have declined. Especially hard-hit are counties that average fewer than two people per square mile, those not adjacent to population centers like Bozeman or Billings, and those that lack natural amenities such as parks and wilderness areas that attract tourists.

Nevertheless, the “buffalo commons” and “big open” concepts ran

into opposition in Montana and elsewhere in the West. The ideas “were too revolutionary,” says Scott. Some local residents worried that the federal government would use the proposals to create new parks and reserves, and institute new rules and regulations telling ranchers and other landowners how to run their lands. As a result of significant opposition, nothing happened for nearly two decades.

The WWF’s interest in the northern Great Plains began in the late 1990s, when it decided to shift some of its focus to North American ecosystems. In 2000, the WWF and 16 other conservation groups formed the Northern Plains Conservation Network, which identified priority areas where biodiversity was most in need of conservation.

“We recognized the need to think big,” Freese says, arguing that only large reserves can truly protect intact ecosystems. Toward that end, the WWF and the APF envision a grasslands reserve that might grow to three to four million acres over the next 20 or 30 years. It would include the 1.1-million-acre Charles M. Russell NWR plus other federal- and state-owned lands. The WWF will provide scientific and technical support while the APF will buy, own, and manage

the land. To date, the APF has bought five ranches totaling 9,000 acres, with grazing rights on public lands for more than 22,000 acres. Freese estimates it could cost more than \$300 million to accumulate several hundred thousand acres. Although no fundraising effort has yet been launched, the APF has raised about \$9 million from donations, grants, and loans.

Nowhere else in the United States is conservation more possible and more essential than in northeastern Montana’s plains, says Jonathan Proctor, the southern Rockies and Great Plains representative of Defenders of Wildlife. There are no large national parks or monuments protecting the Great Plains (the Charles M. Russell NWR encompasses prairies only on its fringes)

There are no large national parks or
monuments protecting the Great Plains and only
1.5 percent of U.S. grasslands are publicly owned.



Bison released on the American Prairie Foundation reserve graze in their new habitat. Five calves have been born since the release.

www.DianeHargreaves.com

and only 1.5 percent of U.S. grasslands are publicly owned. Most of those are in national grasslands that feature cattle, not bison. “The plains are the least represented ecosystem in our national parks,” Proctor adds.

A Native Landscape

Montana's prairies are large, diverse, and mostly unplowed, especially on APF ranches. All of the original native plant species and mixture of plants thought to be on the northern Great Plains before settlement are still present on the ranches today. "We have an intact, native prairie with few exotic species," Freese says. "We don't need to do a lot of restoration" to accommodate the return of bison and other plains animals.

The riparian woodlands along the APF ranches' ephemeral streams are an exception. Decades of cattle grazing and diversions to irrigate farm fields and create livestock ponds have lowered groundwater levels, altered stream flows, and eliminated the occasional floods that supported diverse habitats for plants and wildlife, says Martha Kauffman, a hydrologist and president of Oxbow, Inc., a Bozeman water research company. "Those streams were damaged and old," she adds, thus reducing the number and diversity of woody plants in riparian areas.

To address those problems, the WWF and the APF hired Kauffman to lead a restoration project that began in 2005. Dikes were torn down, berms modified, and culverts added to help restore stream flow on the APF's ranches and the Charles M. Russell NWR. In addition, more than 3,000 cottonwood, willow, and box elder trees were planted along with chokeberry, a tree-like shrub. More dikes and berms will be altered and more trees and shrubs planted this year. Kauffman hopes that these efforts will result in more water flowing in the streams, which could attract more deer, birds, fish, and eventually even beaver again.

Beyond the riparian areas, other researchers have been surveying the ranches' plants and animals. Elizabeth Robinson, director of Wild Things Unlimited, a Bozeman-based education and research firm, spent the better part of two months in 2005 looking for birds. She found 123 species, more than she had expected. Most used riparian woodlands at least partially for nesting, food gathering, or simply resting while migrating through. In places where cattle have overgrazed riparian areas, Robinson found the number of bird species dropped by up to 85 percent. "The higher the plant diversity, the greater the bird diversity," she says.

In places where cattle have
overgrazed riparian areas, Robinson
found the number of bird species dropped
by up to 85 percent.

Among the birds Robinson found on the ranches were black-billed cuckoos, yellow-breasted chats, and black terns, species usually found farther east. The list also included the mountain plover, a bird of special concern in Montana, and the long-billed curlew, a bird found elsewhere along lakes and marshes that in Montana nests in tall prairie grasses. Golden eagles, ferruginous and red-tailed hawks, merlins, prairie falcons, and great-horned and burrowing owls patrol the skies. "Birders would find this a fascinating area," Robinson says. "It's so open and so remote."

Finding the ranches' different birds was difficult and sometimes downright dangerous. Robinson had to drive for miles over dirt and gravel roads, which often became impassable after rain- or snowstorms, even for four-wheel-drive vehicles. Several times she found herself alone on the prairie with lightning and hail approaching from the west. "I kept thinking, 'Okay, where will I be safe?' but there was no place to hide," Robinson says. Fortunately, most storms passed quickly.

Matt Lavin's surveys of the plant communities on the APF's ranches lacked such adventure. Lavin, a professor of botany at Montana State University in Bozeman, and his graduate student Tom Seipel found as great a diversity of plants as Lavin and other researchers have reported elsewhere in Montana. He identified 128 species on 24 test plots, with grass species outnumbering other plant species. Lavin used that number to estimate a total of 337 species based on his and others' work. "Those are as good numbers as you can get out on Montana's sagebrush prairies," he says.

More important, perhaps, Lavin found few exotic or other introduced plants. Less than one percent of the ground cover was taken up by invasive species. Even the weeds Lavin found growing along roadsides were common species native to Montana's grasslands. The most common exotic was sweet clover, which was introduced to feed cattle. Today, with cattle removed from the ranches, it feeds grouse.

Lavin also found that the ranches' grasslands are characterized more by sagebrush and other shrubs than by grasses. The area represents more of an intermediate zone between the tall-grass prairies to the east and mountain woodlands to the west, he says. "We have to



Burrowing owl chicks on the American Prairie Foundation reserve.

www.DianeHargreaves.com



A pronghorn rests on grassland in the U.S. Fish & Wildlife Service's National Bison Range in Moiese, Montana. Government-owned reserves like this one are controversial in ranching communities.



Gerald and Buff Corsi/California Academy of Sciences

The American Prairie Foundation hopes that increasing populations of bison and other prairie species on its Montana reserve will attract thousands of visitors each year.

know what's out there to be able to know what should be there and what we need to restore," Lavin adds.

On one memorable occasion, Lavin looked up from the plants he was examining to see a group of male pronghorn (*Antilocapra americana*) approaching. The pronghorn, which are often called antelopes even though they are not closely related to the antelopes of Africa and Asia, slowly walked toward Lavin, grunting and snorting as if warning a dangerous predator to go away. "As soon as they found out I was a human, they left," a laughing Lavin reports. "It was a classic western scene."

Controversy and Compromise

The WWF's and the APF's plans to create a grasslands reserve in northeastern Montana are not the only ones designed to restore the Great Plains. In Nebraska, for example, the Grassland Foundation is advocating the preservation of ten percent of the state's remaining unplowed prairies. The land might be owned by conservation groups, local or state government agencies, private landowners, or private-public partnerships, says Tyler Sutton, the Grassland Foundation's president.

In particular, Sutton hopes that landowners recognize that wilder-

A lot of ranchers and farmers in Nebraska sell hunting permits, promote bird-watching trips, or operate bed-and-breakfast facilities on their land.

ness areas on or adjacent to their properties can attract visitors and add income. "It's already happening," Sutton says. A lot of ranchers and farmers in Nebraska sell hunting permits, promote bird-watching trips, or operate bed-and-breakfast facilities on their land. Sutton notes that the idea is also catching on in Kansas, where a 5,000-acre Kansas Audubon Society reserve combines wildlife conservation with historic preservation in nearby Bassett.

Sutton warns, however, that efforts to preserve the Great Plains will likely be as controversial in Nebraska as they have been in Montana and other western states. "Many people here fear a massive federal acquisition of land," he says. "It's a very sensitive issue around here. That's why we want to see a local initiative."

It's sensitive in northeastern Montana as well, where some residents and local politicians fear the loss of a ranching lifestyle that has for so long permeated Montana and much of the West, says Randy Shores, a machine-shop owner who sold his family's 2,000-acre ranch to the APF in 2005. On the other hand, Shores adds, ranching in Montana is not what it once was. "It takes a large ranch out here to be profitable," he says. "The land here is not worth much. There are bigger and bigger ranches with fewer ranchers. We wanted

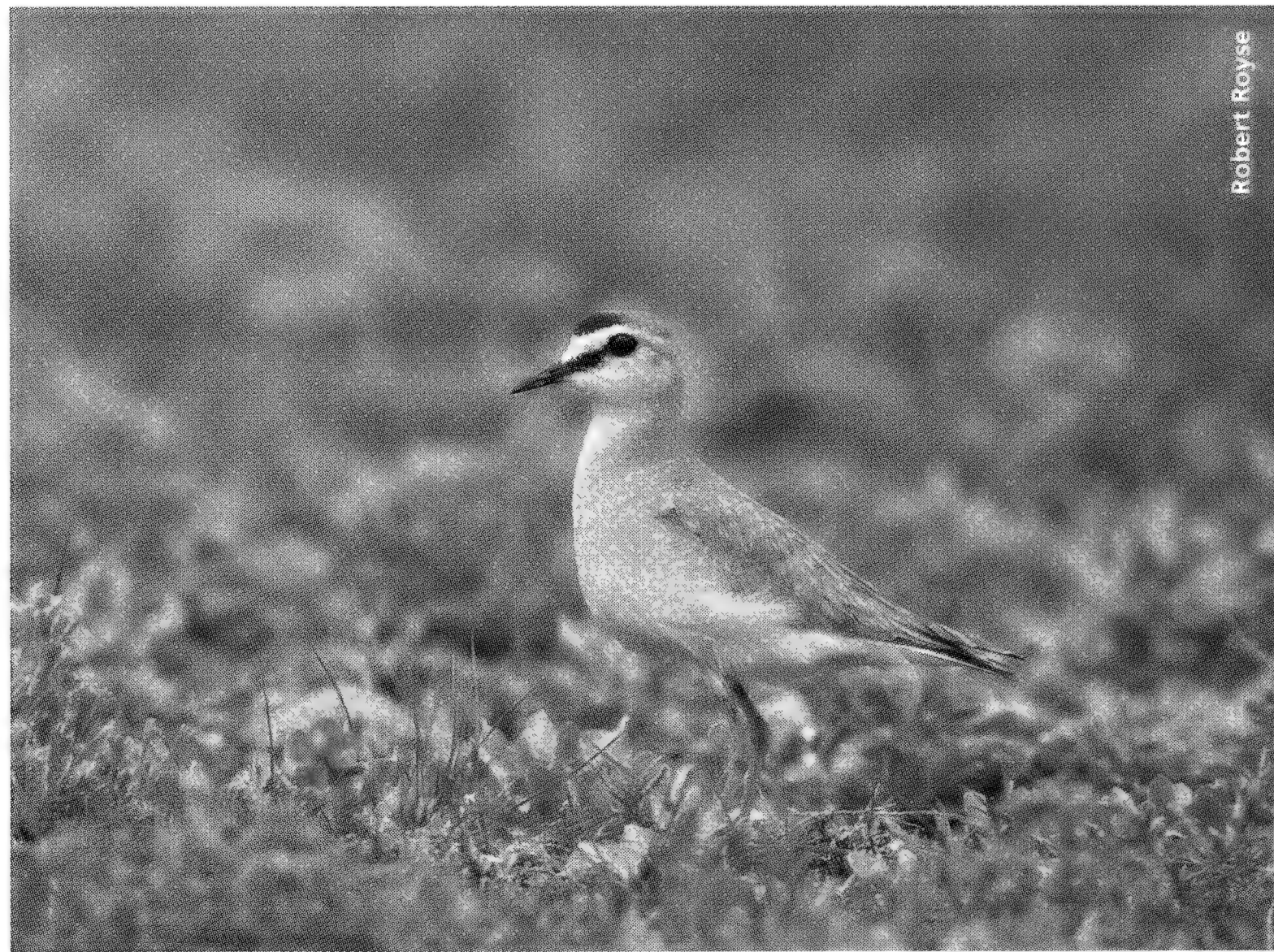
to keep some land ungrazed by cattle. That leaves more room for birds and deer.”

Local fear of too much government intervention may be unfounded. Neither the WWF or the APF is a government agency such as the U.S. Fish & Wildlife Service (USFWS) or the National Park Service. “[The WWF and the APF] can be seen as unaligned with the government and refuge,” says Barron Crawford, a USFWS project leader who oversees the black-footed ferret (*Mustela nigripes*) recovery program at the Charles M. Russell NWR. The WWF and the APF have to obey the Endangered Species Act and other federal laws and regulations, but they cannot impose their own rules on neighboring landowners.

To make sure local residents understand the distinction, Freese, Gerrity, and other WWF and APF staffers attend county council sessions, meet with local officials, and listen to the local advisory committee they formed. “We spent a lot of time talking and listening over coffee and cookies,” Freese says. “We also respect our neighbors’ concerns,” he says, by erecting fences to keep bison on APF lands and radiocollaring them to ensure that wayward animals will be found quickly and brought back.

Further, the APF hired a local rancher to manage its ranches and local workers to build fences and undertake other maintenance projects, Gerrity says. The conservation groups buy food, supplies, and insurance as well as bank locally. They continue to provide hunters access to their lands. And they are helping ranchers and other local residents organize recreational outings to APF ranches.

Perhaps most important, the APF buys land only from willing sellers. Many of the ranches the APF bought were on the market for months with few, if any, interested buyers. In some cases, the only other potential buyers are people who want to develop the land or turn the ranches into private hunting reserves that exclude the public.



Robert Royse

A mountain plover at the Charles M. Russell National Wildlife Refuge.

Other potential buyers might be farmers who will plow the land and change the area’s ranching lifestyle. The bottom line for most westerners, Shores says, is: “It’s [the APF’s] land, they can do whatever they want with it.”

Eventually, Eichbaum, Freese, and Gerrity hope that the grasslands reserve will attract visitors from nearby Montana towns as well as far-away places. “We will continue to provide public access to the land” for hunting, bird-watching, hiking, camping, and horseback-riding, says Sarah Myers, the APF’s director of marketing. “We don’t want to be just a museum piece that no one sees.”

So far, the reserve averages about 250 visitors a year, without coordinated marketing or advertising campaigns, Gerrity says. He hopes one day it will attract thousands each year. To draw visitors and

preserve a part of the Great Plains’ social history, the APF has also restored a one-room house on the ranch that for decades served as the area’s only school.

In the end, WWF and APF staffers harbor no illusions. To recreate a functioning prairie in northeastern Montana that both attracts tourists and maintains the West’s ranching lifestyle, while also supporting the local economy and protecting wildlife and wild places, is a daunting task for conservation groups. “It’s a challenge,” admits Eichbaum. “We’re deliberately going slowly to make sure we do this right.” Z

—Jeffrey P. Cohn is a freelance writer who lives in Takoma Park, Maryland, and specializes in conservation subjects.



Jack Dykinga/USDA ARS

Preserving prairie ecosystems and Montana’s ranching lifestyle is challenging.

BY HOWARD YOUTH

Desert Shell GAME

Desert tortoises' armor-plated and hard shells may protect them from predators, but don't reflect other developmental threats such as drought, fire, and pollution.

The desert tortoise doesn't get anywhere fast. On its rare forays, this football-sized reptile covers a stupefying eight feet per minute. Why hurry? After all, it's already ambled across desert landscapes for ten million years.

Although it's not built for speed, *Gopherus agassizii* excels at surviving in a land of extremes, where a nutritious meal may not be in the offing for two or more years. A desert

tortoise spends about 95 percent of its life in underground burrows, escaping cold or searing heat. But despite the species' low profile, it captures a lot of attention: To those who know and love the Mojave and Sonoran deserts, life without it would be like a Southwest without cacti. It's California's state reptile, and state and federal agencies consider it an indicator species for the health of desert habitats.



But the times are catching up with the desert tortoise. Its shell game—emerging to find bountiful food one year and perhaps none the next—is becoming more treacherous, and its future less certain. Disease, poor nutrition, sprawl, growing traffic, and fires are not only front-page news for humans, they are also factors contributing to desert tortoises becoming scarce in many parts of the arid Southwest over the last 20 to 30 years.

Although the desert tortoise is the best-studied reptile in the Southwest, much remains to be learned about exactly what is driving its declines. Biologists, disease experts, and nutritionists, including some at the Smithsonian's National Zoo, are trying to demystify the tortoise's natural history and conservation requirements. Because the tortoise's fortunes are tied in with those of many other desert creatures and plants, the battle to save it is in many ways a battle to save the desert.

The Tortoise and Its Lair

Desert tortoises live in a wide variety of dry habitats, from flat expanses of the western Mojave Desert sparsely foliated with creosote, white bursage, and Joshua trees to rocky, hilly upland portions of the Sonoran Desert characterized by towering saguaro cacti and feathery paloverde trees. In the United States, desert tortoises live in parts of four states: southern Nevada, southeastern California, extreme southwestern Utah, and western, central, and southern Arizona. In Mexico, they are found as far south as southern Sonora and northern Sinaloa states. In this southern portion of their range, desert tortoises are even forest dwellers. Crawling beneath dense thickets, they may share thorn-scrub forest with military macaws (*Ara militaris*), parrot snakes (*Leptophis diplotropis*), and Mexican tree frogs (*Smilisca baudinii*).

Ongoing lab tests and field studies show that there are genetic, ecological, physiological, and behavioral differences between desert tortoise populations, leading some scientists to conclude that Mojave and Sonoran populations have been isolated from each other for about 5.5 million years. Because of this work, the desert tortoise may in the not-too-distant future be considered desert *tortoises*—a set of similar-looking subspecies or species.

But taxonomy matters not to a desert tortoise sitting at the mouth of its burrow near Tucson or Las Vegas. This creature may have hatched when Dwight D. Eisenhower was president, more than 50 years ago.



A desert tortoise trudges through the 62,000-acre Red Cliffs Desert Reserve in southwestern Utah, which contains most of the species' northern populations.

It used to be that such a ripe old age was common for a tortoise, as long as it survived its first vulnerable decade or two. But many modern dangers now befall adults and young alike, and when populations decline precipitously—as many have in the western part of the tortoise's range—recovery may take centuries, if it comes at all. Tortoises don't reproduce like rabbits. It takes them 15 to 20 years just to reach breeding age. Although Sonoran tortoises rarely lay more than one clutch a year, Mojave females often lay two or, rarely, three in good years; the average clutch of five eggs takes 90 to 120 days to hatch.

Throughout its range, the desert tortoise is the only land turtle, and finding shelter is a key to its survival. Using its strong claws, a tortoise gouges out burrows that extend up to 30 feet long. Desert tortoise burrows host not only their makers, but other creatures large and small seeking escape from the sun, cold, or predators. Within the wide-mouthed, shady tunnels, Andrew Walde, a Helendale,

Tortoises

don't reproduce like rabbits. It takes them 15 to 20 years just to reach breeding age.

California-based wildlife biologist, has found, or found evidence of, seven lizard species including desert iguana (*Dipsosaurus dorsalis*), six snake species, burrowing owl (*Athene cunicularia*), horned lark (*Eremophila alpestris*), a whip-poor-will relative called the common poor-will (*Phalaenoptilus nuttallii*), six rodents, desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and kit fox (*Vulpes macrotis*). Walde has heard that American badgers (*Taxidea taxus*) and coyotes (*Canis latrans*) may also modify the burrows for their use. "My research into the desert tortoise burrows is in its infancy," says Walde. "We do know that virtually every desert vertebrate will go into a desert tortoise burrow. Some snakes and lizards seem to use them more frequently than other desert vertebrates." Walde has also found more than 100 invertebrate species in the burrows, including beetles, moths, ticks, mites, spiders, flies, silverfish, and cockroaches.

Although one tortoise may shuttle between seven to 12 burrows, most of desert tortoises' time is taken up doing nothing at all. "They spend a lot of their life in shut-down mode," says National Zoo re-

of animals and how they may be threatened by changes in the amount and quality of food available to them in their habitats.

Since 1991, Oftedal has often found himself in the Mojave Desert, keeping his eyes on the tortoise and its puzzling diet of desert greens, as well as watching captive tortoises and lab-testing food samples. His goal: To figure out if the tortoise's nutritional needs underlie their perilous state.

Fast Times for a Desert Ancient

While an adult tortoise's hard carapace and thick, tough-scaled legs protect it from many predators, they do little to ward off bulldozer treads, car tires, bullets, cattle hooves, fire, or disease. Humans play direct or indirect roles in all of these dangers, and conservationists have tried to bolster the tortoise's chances. In 1990, following sharp declines in Mojave populations and concerns over a rapid spread in disease and the expanding scope of development and other disturbances, the U.S. Fish & Wildlife Service (USFWS) included about 30 percent of desert tortoise populations on the Endangered Species

List, including those in California, Nevada, Utah, and far northwest Arizona. These populations are now listed as threatened with extinction, and despite their presence on the list for the last 16 years, many declining populations continue to fall in numbers.

In developed areas like Tucson and Las Vegas, it's easy to see why. Once small human enclaves surrounded by broad desert expanses, these southwestern cities are spreading farther into the desert, bringing new roads, garbage dumps, subdivisions, shopping malls, and other barriers that stifle tortoise movement. While such construction is tough on tortoises, it benefits one of their main predators, common ravens (*Corvus corax*). This species, the largest of the crow family in North America, nests on power towers, raids trash cans and landfills, eats road kill, drinks fountain water, and is doing better than ever before.

Over the last 37 years, raven numbers grew by some 800 to 1,400 percent in the Mojave



In rainy years, desert tortoises choose evening primroses (above) and other plants high in protein and water relative to potassium.

search nutritionist Olav Oftedal. "Their strategy basically is to get down in a hole and wait it out. Their area of expertise is 'if you don't like it, just wait. It's going to get better, hopefully.'"

As head of nutrition at the Zoo's Department of Conservation Biology, Oftedal has studied the nutritional requirements of a variety

and Sonoran deserts, according to a recent analysis of data from the North American Breeding Bird Survey, an annual bird count coordinated by the U.S. Geological Survey and the Canadian Wildlife Service. "Threats [to prey species including desert tortoises] from ravens may be particularly severe because predators are more likely

Charles T. Bryson/USDA ARS



to cause extinctions in prey when food subsidies [i.e. road kill or meat scraps at the dump] allow their populations to remain high as prey populations decline,” wrote biologists William B. Kristan III, William I. Boarman, and John J. Crayon in the *Wildlife Society Bulletin* in 2004.

At hatching, young tortoises are about the size of a quarter. For their first five to ten years, the small reptiles have soft shells and are what Oftedal calls “walking morsels.” Many fall prey to ravens, and others are killed by coyotes, kit foxes, western spotted skunks (*Spilogale gracilis*), golden eagles (*Aquila chrysaetos*), some snakes, southern fire ants (*Solenopsis xyloni*), and white-tailed antelope squirrels (*Ammospermophilus leucurus*).

Even more far-flung places can turn into tortoise danger zones. Off-road vehicles rumbling over open desert crack shells and flatten burrows. Military maneuvers at some desert bases necessitate the removal and relocation of desert tortoises that would likely be killed by tanks and other machinery or munitions. Despite legal protections that prohibit harming them, tortoises sometimes prove irresistible targets for rifle-toting pot-shooters. And sheep and cattle, which methodically chew down the scant vegetation tortoises need to survive, also sometimes trample the reptiles.

Although the landscape has become increasingly complicated for tortoises to navigate, under the USFWS species recovery plan for the Mojave desert tortoises, thousands of acres are now protected from many of these hazards. So why are tortoises still disappearing, even from the best-protected areas?

Fire is one of the less-predictable factors. In the summer of 2005, for example, 14,741 acres of the Red Cliffs Desert Reserve near St. George, Utah, were scorched; 10,446 acres, or 71 percent, of these were tortoise habitat at the northeastern extreme of the species’ range. An estimated 38 percent of the reserve’s adult tortoises died in the fire or were killed by smoke.

Many fires in the Mojave Desert, set off by lightning or by discarded cigarettes, hot tailpipes, or arsonists, spread fast and far, fueled by dense mats of non-native annual grasses that fill once-open gaps between native plants. Oftedal and his colleagues have also noted that these introduced plants, including Mediterranean grass (*Schismus barbatus*) and red brome (*Bromus rubens*), are not optimal tortoise foods and crowd out more nutritious native plants.

But invisible threats—pathogens—may do far more damage than fire or invasive exotic plants. As males battle over mates, pairs copulate, and individuals share burrows, many are becoming infected with

the highly contagious upper respiratory tract disease (URTD). This ailment is spread via body fluids and caused by recently described bacteria *Mycoplasma agassizii* and *M. testudinum*.

Scientists can test wild tortoises for antibodies to *Mycoplasma* and know that some wild populations of desert tortoises and their relatives in the southeastern U.S., gopher tortoises (*Gopherus polyphemus*), have been exposed to the disease. Visible symptoms of active infection include swollen eyes, runny nose, and labored breathing. While these outward signs might not sound alarming, URTD causes lesions in respiratory passages in the head and is associated with large tortoise die-offs. As far as is known, infected tortoises never recover, but they may enter a long, dormant phase in which they do not exhibit symptoms. URTD is widespread in the western Mojave and some other areas, but its occurrence varies.

In 1988, URTD was first linked with a major wild tortoise die-off, in southern California’s 24,700-acre Desert Tortoise Research Natural Area, a protected haven for a particularly large population of the reptiles. Between 1979 and 1992, the total tortoise population density within the reserve dipped by 76 percent, while a 90 percent loss of adults was noted. “The deaths of [these] tortoises and the population declines are attributable to several causes. ...However, between 1988 and 1992 the declines of adults are clearly attributable to URTD caused by *M. agassizii*,” wrote U.S. Geological Survey tortoise biologist Kristin H. Berry in the 1997 proceedings of an international conference on tortoise and turtle conservation.

Desert tortoises may be able to stave off sickness through proper nutrition. Oftedal, along with bacteriologist Mary Brown of the University of Florida in Gainesville and immunologist Jerry Simecka of the University of North Texas in Denton, plans to study the possible link between nutrition and the tortoise’s immune response to URTD. “It makes sense that a downhill slide in tortoise nutrition would lead to both greater expression of disease in individual tortoises and to increased transmission of the disease throughout the population,” says Oftedal. “That’s what we plan to study in more detail.”

“We now suspect that it was not just a ‘Typhoid Mary’ situation—that the *Mycoplasma* is probably a long-term resident in the population but when animals become stressed by, for example, prolonged drought, inadequate nutrition, habitat disturbance, or other environmental factors, they catch the disease and spread it to their weakened neighbors,” says Oftedal. He adds, “Disease outbreaks probably arise due to a combination of human-induced and natural causes.” URTD’s epidemiology remains poorly understood. No

In the summer of 2005, 14,741 acres of the Red Cliffs Desert Reserve near St. George, Utah, were scorched; 71 percent of these were tortoise habitat at the northeastern extreme of the species’ range.

one knows, for example, how long desert tortoise populations have harbored *Mycoplasma*, what conditions are required for rapid transmission, or why some outbreaks are so deadly, killing 70 to 80 percent of a population in a few years.

Another illness, cutaneous dyskeratosis, turned up in wild tortoises starting in the 1980s. It creates lesions on limbs and shell plates, or scutes, but likely indicates more serious illness.

Cutaneous dyskeratosis may have contributed to some localized population declines, such as a 54 percent population drop and 61 percent adult tortoise decline noted between 1982 and 1992 in another California tortoise reserve, the Chuckwalla Bench Area of Critical Environmental Concern. Pathologists aren't yet sure of its cause, but speculate that nutritional deficiencies or naturally occurring or human-wrought toxic chemicals may play a role. Herpesvirus also poses a potential threat to captive and wild tortoises.

Keeping in Step with PEP

Oftedal and his Zoo nutrition lab colleagues have analyzed thousands of plant samples from about 400 species, and observed tortoises take tens of thousands of bites out of plants in the Mojave and Sonoran deserts.

Thanks to this painstaking work, they now know that tortoises count on plants that seldom appear. In areas such as the western Mojave and northwestern Sonoran deserts, if rainfall arrives, it usually comes during winter, when desert tortoises are dormant in their burrows and their metabolic rates are low. When tortoises emerge in spring and become active, there may be little rainfall and, consequently, few plants. "They basically have to get all of their water from their food," says Oftedal, "and in dry years they may not get any food for more than a year."

Zoo nutritionists have analyzed thousands of plant samples from about 400 species, and observed tortoises take tens of thousands of bites out of plants in the Mojave and Sonoran deserts.

Unlike many other reptiles, including desert iguanas, desert tortoises do not have specialized salt glands to excrete excess potassium—an element that is abundant in many desert plants because it helps draw moisture from dry soils—but frequently consume plants with higher concentrations of potassium than they can void in fluid urine.

Oftedal says that this situation is akin to humans drinking seawater.

Desert tortoises cannot afford to accumulate potassium in their bodies because it is potentially lethal. (Potassium salts, for example, are used for euthanasia.) So, to get rid of potassium, Oftedal says they "rob Peter to pay Paul": They divert the protein in their food to produce a waste product, uric acid, that precipitates in their bladders in the form of potassium urates. On high-potassium diets, tortoises must use their protein for potassium excretion rather than for growth of tissue or development of eggs. Under these circumstances, potassium robs them of nutrients they would otherwise use to maintain body condition, which is particularly detrimental for females striving to produce eggs.

In dry years, tortoises may find no food or just some shriveled cacti or dried grasses. In moderate-rainfall years, they find a limited array of foods, including some non-native grasses, and just get by. But in wet years, when winter rains bring an inch or more of water to nourish abundant spring vegetation, Oftedal and his colleagues have found that tortoises become extremely selective in what they eat. In these years, tortoises seek out plants with high levels of what Oftedal calls PEP—Potassium Excretion Potential. High-PEP plants are high in protein and water relative to potassium, so there is plenty of surplus for the tortoises to store in their tissues and developing eggs. "With high-PEP plants," says Oftedal, "tortoises can make up this difference and forge ahead. This is very important in terms of reproduction, juvenile survival, and disease."

High-PEP plants include various legumes and evening primroses; some plants, such as smooth desert dandelion (*Malacothrix glabrata*), produce high-PEP leaves that small tortoises seek. Most of these plants are annuals that survive from year to year as seeds in the soil but only germinate in response to heavy winter rains, showing in the spring. "Tortoises really chow down when they get a big rainfall year like an El Niño year, when flowers carpet the deserts," says Oftedal. This might happen only every four or five years, between which a drought or two may hit and modest rainfall years fill the gaps. Like many other aspects



Desert tortoise eggs incubate for 90 to 120 days in nests excavated in the soil. Hatchlings emerge with soft shells and are about the size of a quarter.



Joe McDonald

It's literally feast or famine for desert tortoises. In rainy years, they can afford to be choosy about the vegetation they eat, although grazing cattle and invasive plant species are reducing their options. In seasons with little rainfall, however, they may not eat for more than a year.

of the tortoise's biology, the situation varies from place to place and year to year due a combination of time, temperature, and rainfall.

Oftedal and others worry that stressors such as invasive plants and overgrazing further push tortoises to the brink by cutting supplies of already sporadic high-PEP plants. A 1998 U.S. Geological Survey study found that in at least part of the Mojave Desert, cattle went after some of the same high-PEP foods as tortoises, consuming them before tortoises could.

Some of Oftedal's work has helped influence land-management decisions in cattle country leased out by the Bureau of Land Management, or BLM. The BLM, part of the U.S. Department of the Interior, oversees about 75 percent of remaining high-quality tortoise habitat, but in many parts of the West, environmentalists accuse it of favoring cattle concerns over those of wildlife.

This was not the case in southern Nevada, where hard-scrabble pastures are now bathed in the glow of booming Las Vegas. There, The Nature Conservancy helped mediate the buyout of ranchers' allotments on BLM land and local, state, and federal agencies worked with developers to forge the Clark County Habitat Conservation Plan. The plan ensures conservation of tortoise and other wildlife habitat while allowing development in some desert tortoise areas, including the Las Vegas metropolitan area. Developers pay mitigation fees that fund research and the Desert Tortoise Conservation Center southwest of Las Vegas, where many tortoises displaced by development are relocated.

On some former BLM grazing areas, Oftedal and his colleagues have documented the return of high-PEP plants after cattle were

removed in the early 1990s. Their survey work, funded in part by Washington, D.C.-based Defenders of Wildlife and the California-based Redlands Institute, also documented a high abundance of high-PEP plants in the northeastern and western Mojave Desert and in the Sonoran Desert. "But the vast bulk of the Mojave had low densities and we suspect livestock have something to do with this," says Oftedal.

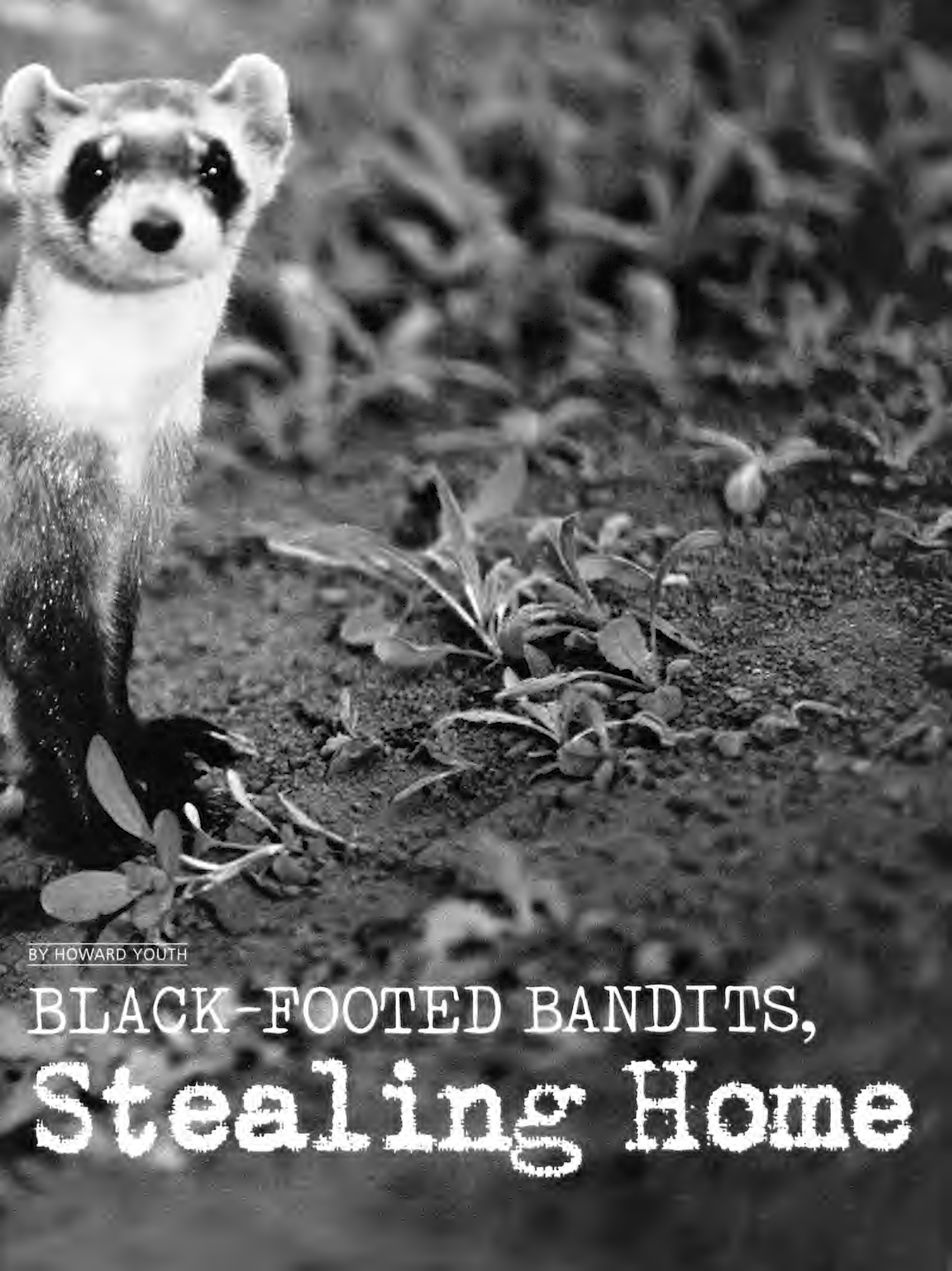
Oftedal hopes conservationists can move along the recovery of high-quality tortoise habitat. He is working with the U.S. Department of Agriculture and the University of Arizona in Tucson to propagate high-PEP plants for desert restoration programs that reclaim fire-scorched, overgrazed, or bulldozed areas. Right now few, if any, restoration projects use legumes or other plants beneficial to desert tortoises.

Big changes are afoot in tortoise country, but Oftedal and many other conservationists and concerned citizens have the plodding tortoise's welfare in mind. "It's the large vertebrate that people identify with deserts out there," says Oftedal. To many, the tortoise is the desert and it is hard to imagine hiking in the arid open and knowing there are no tortoises down there, burrowed under the ground with countless other creatures, waiting for the green flush that follows a good winter rain. Z

—Contributing editor Howard Youth writes on a variety of conservation-related issues.



In 1984, the last 18 black-footed ferrets in the world were captured on a Wyoming ranch. Thanks to breeding and reintroduction programs the Smithsonian's National Zoo helped create, about 550 now live in the wild in six states and Mexico.



BY HOWARD YOUTH

BLACK-FOOTED BANDITS, Stealing Home

All may seem tranquil above the surface of a prairie dog town, but danger lurks below. Deftly infiltrating a labyrinth of burrows with ninja-like stealth and speed, the black-footed ferret (*Mustela nigripes*) seizes sleeping prairie dogs by night, and rests in their burrows by day. While this mink-sized, tubular-bodied carnivore seems to have found itself a good niche, its specialized diet and behavior binds it to the misfortune of its once-abundant prey.

Ranchers have long considered prairie dogs (*Cynomys* spp.) competitors for the grasses eaten by their cattle and sheep, and complain that prairie dogs' burrow entrances pose a hazard to loping livestock. After more than a century of being shot, poisoned, trapped, and bulldozed, prairie dogs are now found on just two percent of the approximately 100 million acres they once inhabited.

Populations of black-footed ferrets, burrowing owls (*Athene cunicularia*), mountain plovers (*Charadrius montanus*), and other wildlife closely associated with prairie dog towns vanished in turn. By 1964, the black-footed ferret, once a fixture in the western Great Plains from Canada to northern Mexico, was known to survive in just one area of South Dakota. By 1974, even this population was gone, leading many to conclude that the ferret, 123 years after its first formal description by John James Audubon and John Bachman, was gone forever.

The ferret resurfaced in 1981, thanks to a dog. After romping around on a ranch in remote Meeteetse, Wyoming, about 50 miles east of Yellowstone National Park, the canine carried home a long, sand-colored mammal with a blackish mask, tail tip, and black "stockings." The dog's owners sought wildlife officials' help in identifying the weird dead creature, and their inquiry led to the location of a back-from-the-brink population of about 130 black-footed ferrets in Meeteetse.

Three years later, sylvatic plague, the same illness known as Black Death in medieval Europe, killed off many of the Meeteetse-area prairie dogs, and canine distemper virus nearly wiped out the ferrets. (Although plague in humans is now easily treated with antibiotics, it

can sweep through a prairie dog colony like wildfire.) Fearing another disaster, state and federal conservationists took the remaining 18 ferrets out of the wild and enlisted them in breeding efforts.

After the U.S. Fish & Wildlife Service (USFWS) published its 1988 Black-footed Ferret Recovery Plan, Smithsonian National Zoo scientists were invited to take a lead role in studying and breeding one of the most endangered carnivores in the world, work that continues 25 years—and 282 zoo-born ferrets—later.

Scientists at the National Zoo's Conservation and Research Center work with other zoos, land managers, and biologists to learn more about how the black-footed ferret breeds and to boost the species' chances through assisted-breeding techniques such as cryogenically preserving sperm and artificially inseminating females, to improve reproductive efficiency. (Zoo scientists developed reproductive science specific to the black-footed ferret by studying two of its closest relatives, the domesticated ferret, *Mustela putorius furo*, and the steppe polecat, *Mustela eversmannii*.) With artificial insemination, females can conceive young with males that would otherwise not be represented in the breeding program's

gene pool, including males of underrepresented lineages.

While their overall goal has been to increase the number of young produced for potential reintroduction into the wild, Zoo scientists and their colleagues have learned many other important things along the way. For example, they found that black-footed ferrets lack Interleukin 6, a protein that plays a key role in regulating the immune system. Interleukin 6 inhibits inflammatory response to disease, and



Aggressive persecution of prairie dogs nearly starved black-footed ferrets into extinction.

Gaby Gollub/FONZ



This black-footed ferret was born at the National Zoo's Conservation and Research Center and released into Arizona's Aubrey Valley.



Randy Matcett/USFWS

Black-footed ferrets live and hunt in prairie dog towns, emerging at night to raid nearby burrows. Although prairie dogs account for about 90 percent of their diet, black-footed ferrets also eat mice, squirrels, and birds on occasion.

its absence in black-footed ferrets may explain why they often die from intestinal parasites that other ferret species survive.

Beginning in 2002, Zoo scientists also collaborated with organizations and other zoos on a survey of the health of black-footed ferrets at all reintroduction sites, including ferrets that had been released and those born in the wild. They found, among other things, that ferrets remain susceptible to sylvatic plague, which can wipe out their prey and potentially kill them too, and that reintroduced ferrets need to be vaccinated against canine distemper. After analyzing 253 different animals, the team found that populations at some sites, such as the Conata Basin in South Dakota, continue to do well, while others require periodic reintroductions, and others, such as those in Montana, are crashing.

Now, 25 years after the rediscovery of black-footed ferrets in Meeteetse, the future of one of the United States' most endangered mammals appears far more promising than it did in 1981. For one thing, the species' survival no longer rests with just one disaster-prone population. Today, about 550 wild black-footed ferrets live in six states within their former range—Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming—and there is now also a small group reintroduced and living in Chihuahua, Mexico. Scientists hope that placing these animals in different parts of the species' once-wide range will increase their numbers and protect them from total annihilation if major disease outbreaks or severe droughts strike. In addition, almost 300 more ferrets are in various breeding facilities and

about 20 others are on exhibit at zoos, bringing the total population of this once-lost species to about 870.

The situation, while promising, remains tense. Prairie dog colonies are still being bulldozed, shot out, and poisoned, and the twin threats of plague and distemper show no signs of letting up. The ferret's largest plague-free stronghold, Conata Basin, holds about half the remaining wild ferrets, but now lies at the edge of plague's advance. Conservationists are waiting to see what happens: If the disease threat becomes dire, they may capture the Conata Basin ferrets before plague ravages their food source and perhaps attacks them. Wildlife officials have already dusted the area with insecticide to reduce the population of fleas, which are vectors of the sickness.

While the USFWS lists the black-footed ferret as endangered, all known wild populations originate from animals born in the breeding program. These populations are designated "experimental and nonessential" by the USFWS, a status that sits better with private landowners, who are more likely to cooperate with government-supported conservation efforts if they know such collaboration won't strictly limit their land-use options.

Given the continuing challenges, habitat protection, zoo breeding, careful monitoring, disease surveys, and reintroductions will remain priorities as conservationists strive to meet goals set by the USFWS Black-footed Ferret Recovery Plan—namely, the establishment of at least ten self-sustaining, free-ranging populations totaling around 1,500 animals. *Z*

The Omnivore's Dilemma: A Natural History of Four Meals

Michael Pollan. 2006. The Penguin Press, New York. 450 pp., hardbound. \$26.95.

In a startling but apt metaphor, Michael Pollan likens the modern American supermarket to a landscape filled with plants and animals from which we must choose what to eat. If we had specialized diets like koalas and giant pandas do, the choice would be easy: Head straight for the eucalyptus or bamboo aisle, load up the basket, and go. But we don't. Human beings are omnivores, and the omnivore's dilemma of Pollan's title refers to the fact that we, like other animals that eat a variety of foods—plants, animals, fungi—must figure out what's good to eat and what's not. What will nourish healthy bodies and what will sicken or kill us?

Until recently, cultural patterns borne of tradition, taboos, and rituals pretty much dictated what people ate, and in most places at most times the choices were relatively small. When I was growing up, dinner was baked or grilled chicken, beef, or pork, with mashed or baked potatoes, boiled peas or carrots, bread and butter, and a glass of milk—all prepared with few adornments beyond salt and pepper. Had I asked my parents what is this stuff I'm eating and where did it come from, they could have answered.

No more. Most of the supermarket landscape is not given over to recognizable animals, fruits, and vegetables. Rather, it is filled with bottles, boxes, cans, and plastic containers of processed food, and their labels list obscure ingredients with no clue as to what they are or where they came from. Other label blurbs tout healthful properties, such as low-fat, no-carb, or whatever the last medico-dietary fad of the moment helps sell products. We also face what might be called ethical labels on increasingly more food items: organic, cage-free, free-range, wild, farmed, and the like. What do those mean and how should they

affect food choices? On the flip side, how do our choices affect not only our personal well-being, but the well-being of the planet?

In *The Omnivore's Dilemma*, Pollan sets out to answer these questions by tracing three food chains that result in the ingredients of four different meals. Along the path of reaching each of these meals, he explores food and our relationship to it from multiple diverse perspectives. Eating, more than any other human activity, "constitutes an engagement with the natural world. As ecology teaches, and this book tries to show, [sun, soil, and what we eat are] all connected, even to the Twinkie." But today, it's "hard to see how." Pollan was driven to undertake this project by a deep desire to eat knowledgably, and share what he learned so the rest of us can too.

Pollan's three food chains are industrial (the way most of us eat today), pastoral (divided into big industrial organic and small ecological organic), and personal (a meal he hunted and gathered himself). Each of these three journeys tells stories I found surprising, and you may too. Did you know, for instance, that most of the supermarket chickens labeled "free-range" merely have the opportunity to go outdoors, and most never do? That it's possible to go pig-hunting just outside of San Francisco? That a single farm in Virginia forms its own sustainable ecosystem that creates food from nothing more than the input of sunlight and human labor?

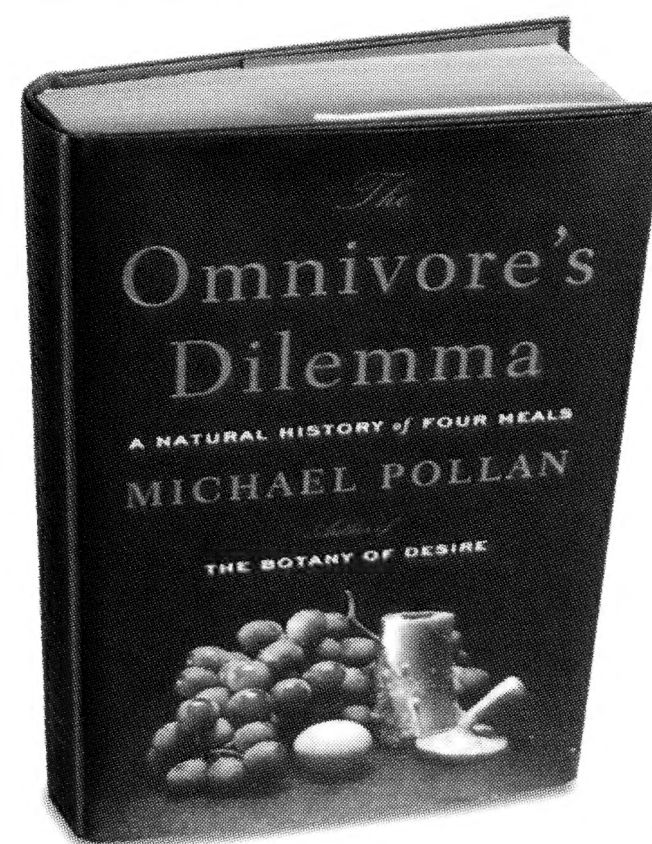
But most surprising, and scariest, is Pollan's explication of the industrial food chain, an invention of the last 50 years or so that is based

almost entirely on corn and petroleum. We eat so much corn, disguised in any number of ways, that Pollan quotes one scientist who says, "When you look at the isotope ratios [in body tissues] we North Americans look like corn chips with legs." In other words, we may think of ourselves as omnivores, with more choices of diverse food items from every corner of the Earth than ever, but we are actually heading toward a panda-like specialization on a giant grass!

Whether that is good or bad—I personally think that being stew and salad is better or at least more interesting than being a corn chip—this sort of industrial agriculture is not sustainable. When you factor in the costs of the fossil fuels that go into producing corn as we do now, it takes more than a calorie of fuel to produce a calorie of food. As Pollan puts it, "From the standpoint of industrial efficiency, it's too bad we can't simply drink the petroleum directly..." And this calculation doesn't factor in other costs, including wetlands poisoned by fertilizer runoff, biodiversity lost to a monoculture of corn, and human health undermined by a new and unprecedented diet.

When a person or animal must continually spend more energy to obtain a meal than the meal provides, that individual's body begins to eat itself and eventually dies. The same principle applies on a societal scale to our corn-petroleum diet. Unwittingly, we have been eating ourselves to death. By learning to eat knowledgably, starting with reading this book, we can return to eating for life.

—Susan Lumpkin



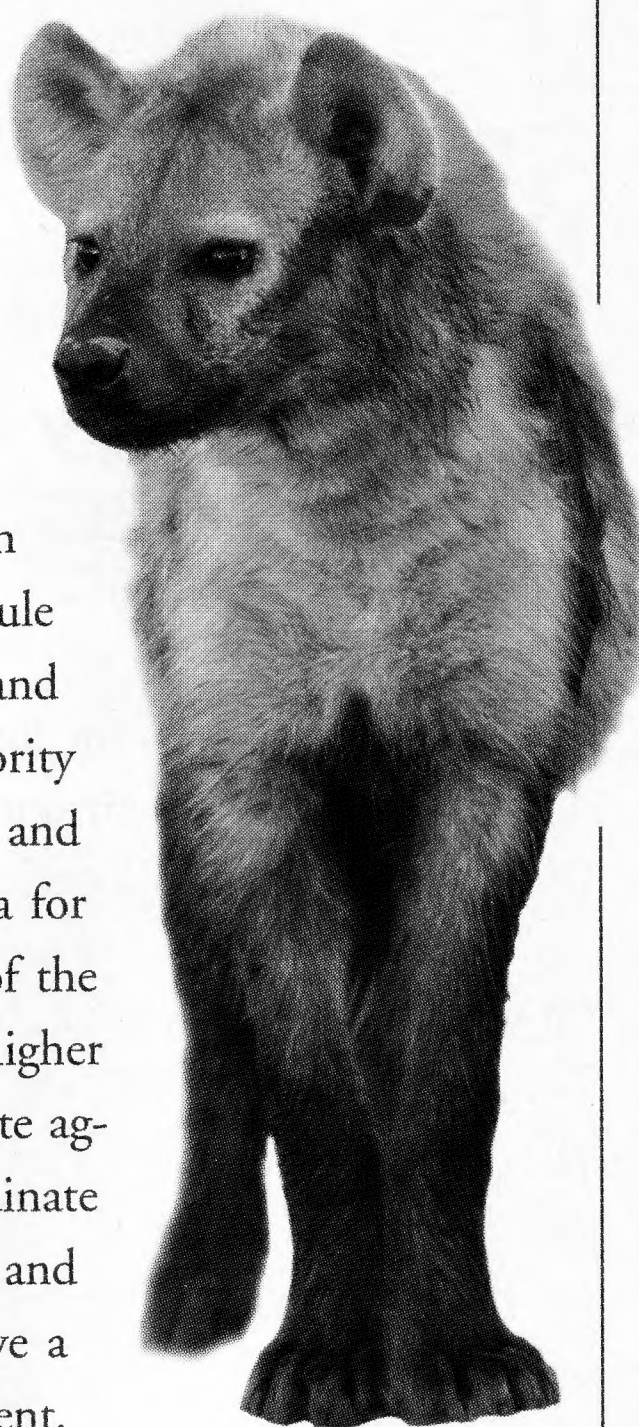
BioAlmanac

by Shannon Lyons

Born to Lead

Some lucky spotted hyenas (*Crocuta crocuta*) are the aristocrats of the scavenger set, inheriting their mothers' elite social standing while they're still in utero, according to a study published in the April issue of *Nature*.

Spotted hyena females are larger and more aggressive than males. The most dominant among them—alpha females—rule clans of 40 to 60 hyenas and have their pick of the best food and mates. To find out how alpha females pass their social superiority to their offspring, scientists from Michigan State University and the University of Nebraska at Omaha studied a clan in Kenya for nearly two decades. They found that during the second half of the gestation period the fetuses of alpha females are exposed to higher concentrations of androgens, a group of hormones that mediate aggression and the development of muscles, than fetuses of subordinate females. Consequently, alpha females' cubs are more aggressive and sexually vigorous than their subordinate counterparts and have a better chance of surviving in their ultra-competitive environment. Previous studies have shown that the social ranking of some female birds affects the amount of androgens in the eggs they lay, but this is the first study to show that prenatal androgen exposure can affect the social status of a wild mammal.



What's in a Name?



The word "shrew" probably originated with the Old English word *screawa*, meaning "shrew-mouse," and centuries later the misconception that shrews are close cousins of mice is still common. Shrews do resemble mice in both size and shape, but are not rodents.

Just as shrews are likened to mice, peevish women are likened to shrews. Kate, the eponymous heroine of Shakespeare's *The Taming of the Shrew*, becomes aggressive when threatened, as do most of the world's 300-

plus species of shrews. And while Kate attacks her suitors with venomous words, at least three species of shrews attack their prey with venomous saliva. Perhaps a man unfortunate enough to experience a painful upbraiding from a scornful woman and the painful bite of the Eurasian water shrew (*Neomys fodiens*) joined the two in linguistic longevity.

The adjective "shrewd," which originally meant "mischievous" and now means "artful" or "wily," aptly describes Kate's husband, Petruchio. "Shrewd" may have its roots in an ancient belief, noted by Aristotle in *The History of Animals*, that "The bite of the shrewmouse is dangerous to horses and other draught animals as well," and a subsequent superstition that shrews are malicious creatures that paralyze cattle by scampering over them. The folk remedy for a shrews' mischief is to touch the victim with a branch from a tree in which a live shrew is imprisoned.

Why Do Robins Cock Their Heads?

As an American robin (*Turdus migratorius*) hops along in search of food it often pauses to tilt its head to one side for a few seconds, then the other side before stabbing the ground with its beak. Scientists agree that head-cocking helps robins locate prey but aren't certain how. The birds may be listening intently for the sounds of invertebrates, including worms and grubs, burrowing underground or they may be taking a closer look at their prey. Because robins' eyes are located on the sides of their heads, they can't simply look down to see the ground in front of them, but instead must bring each eye close to the ground in turn.

Fact or Fiction: Goats Eat Everything

Rumor has it that domestic goats eat tin cans, the laundry off the line, and just about anything else. It's true that goats eat plants that seem unpalatable such as tree bark, brambles, and poison ivy. But they refuse to eat dirty or trampled food and their stomachs are so sensitive that sudden changes in diet, overeating, or consuming green hay can cause them to bloat fatally. The tin-can rumor probably stems from goats' habit of investigating unknown objects with their tongues and lips. A curious goat may nibble on a paper label affixed to a tin can but it won't consume the metal underneath.

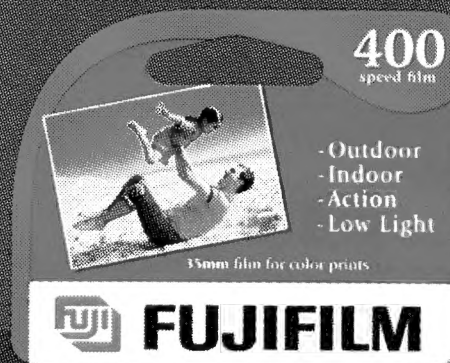
In Season

From July to October clusters of brownish-purple flowers bloom on groundnut (*Apios americana*), a legume that grows in the eastern half of North America. Groundnut tubers were a staple food for some Native Americans and colonists in New England. Eaten raw, boiled, roasted, or ground into flour, they contain more than three times the protein of potatoes. In *Walden*, Thoreau describes the groundnut as "the potato of the aborigines, a sort of fabulous fruit," and goes on to say: "It has a sweetish taste, much like that of a frost-bitten potato, and I found it better boiled than roasted. ...Some Indian Ceres or Minerva must have been the inventor and bestower of it." Groundnut is also called, among other things, Indian potato, American potato bean, and Dakota pea.



Blue-eyed lemurs (*Eulemur macaco flavifrons*) are the only primates that have blue eyes, besides humans.

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Fujifilm's support helped the National Zoo bring giant pandas Mei Xiang and Tian Tian to Washington, and is assisting the Zoo's experts to develop the scientific knowledge they need to ensure the survival of pandas in the wild. Fujifilm also supports comprehensive conservation education programs designed to help children and adults learn more about giant pandas and the conservation of all wildlife and their habitats.

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